John W. THOMSON*: *Haematomma lapponicum* Räs. in North America**

J・W・タムソン*: 北米産のイワザクロゴケについて**

Haematomma lapponicum is an attractive crustose lichen on rocks in arctic and alpine localities. With its blood-red apothecia and bright yellow thallus it closely resembles *Haematomma ventosum* (L.) Mass. but differs from it in the KOH − instead of KOH + yellow reaction as was first shown by Räsänen (1931). It is a circumpolar species whereas the latter species is confined to Europe. A preliminary study of the two species has been published by Culberson (1963) but no detailed statement of the range in North America was made as the present writer was collecting data at that time and was expected to publish later.

Chemistry Some rather curious errors have occurred and been published upon in studies of these two species of *Haematomma*. Solberg (1957) stated that together with usnic and divaricatic acids, *Haematomma lapponicum* contained thamnolic and ventosic acids, the latter a new substance. However the presence of thamnolic acid would give a yellow KOH reaction and orange-red P reaction rather than the negative reactions of *H. lapponicum*. Study of Solberg's paper showed that he selected his material in the field using a positive paraphenylenediamine reaction to choose the plants which he would use for his extractions. As the P + test, like the KOH + test, shows the presence of thamnolic acid, he was obviously selecting for his investigation material of *H. ventosum* rather than *H. lapponicum*. Culberson (1963), using only paper chromatography to study the chemistry, stated that *H. ventosum* contained usnic, divaricatic, and fumarprotocetraric acids. Asahina (1964) pointed out that thamnolic and fumarprotocetraric acids may have the same Rf value in paper chromatography, and by use of the G. A. An. solution he demonstrated the presence of thamnolic acid rather than fumarprotocetraric acid in European material of typical *H. ventosum*.

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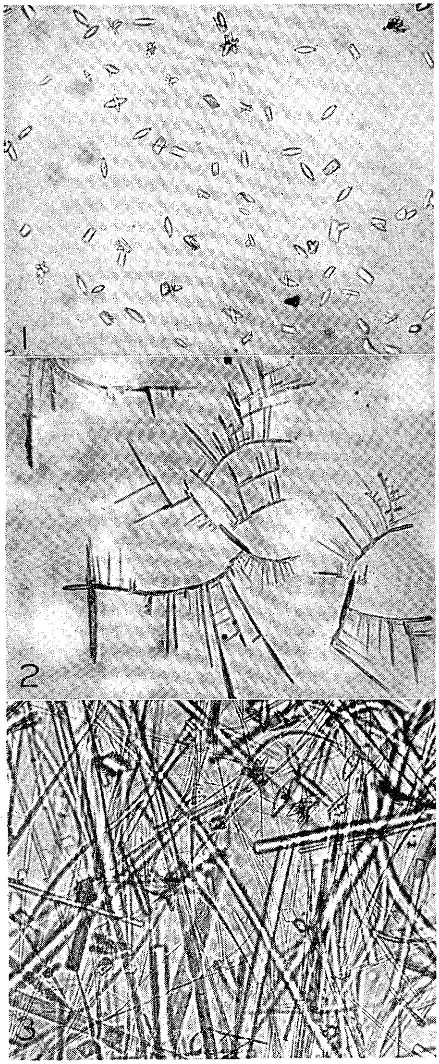

Figs. 1-3. 1. Barbatic acid in G.E. from *H. lapponicum*; ca. 400×. 2. Divaricatic acid in G.E. from *H. lapponicum*; ca. 400×. 3. Usnic acid (elongate square-ended prisms), divaricatic acid (trichites), and barbatic acid (small rhombs and boat-shaped crystals) in G.E. solution from *H. lapponicum*; ca. 800×.

The current writer, using the standard microcrystallization techniques of Asahina, obtained from European KOH + yellow material (*H. ventosum*) the typical boat-shaped yellow crystals of the thamnolic acid reaction with $Ba(OH)_2$. By use of the G. E. test solution he demonstrated the usnic acid and divaricatic acid and in addition small, boat-shaped, clear crystals which resemble those of barbatic acid (Fig. 1). American material all has a negative KOH reaction and should be classified as *H. lapponicum*. It lacks thamnolic acid. By use of the G. E. test the writer established that usnic and divaricatic acids are constant substances in this species (Figs. 2 & 3). In 9 out of 66 samples tested (14%) barbatic acid was present (Fig. 1), and in 2 thalli (4%) zeorin was present. Apparently barbatic acid and zeorin are accessory substances in *H. lapponicum*. All 8 European specimens of *H. ventosum* tested contained barbatic acid in addition to the usnic, thamnolic and divaricatic acids. None contained zeorin. At several localities in the American arctic the writer collected individual thalli and

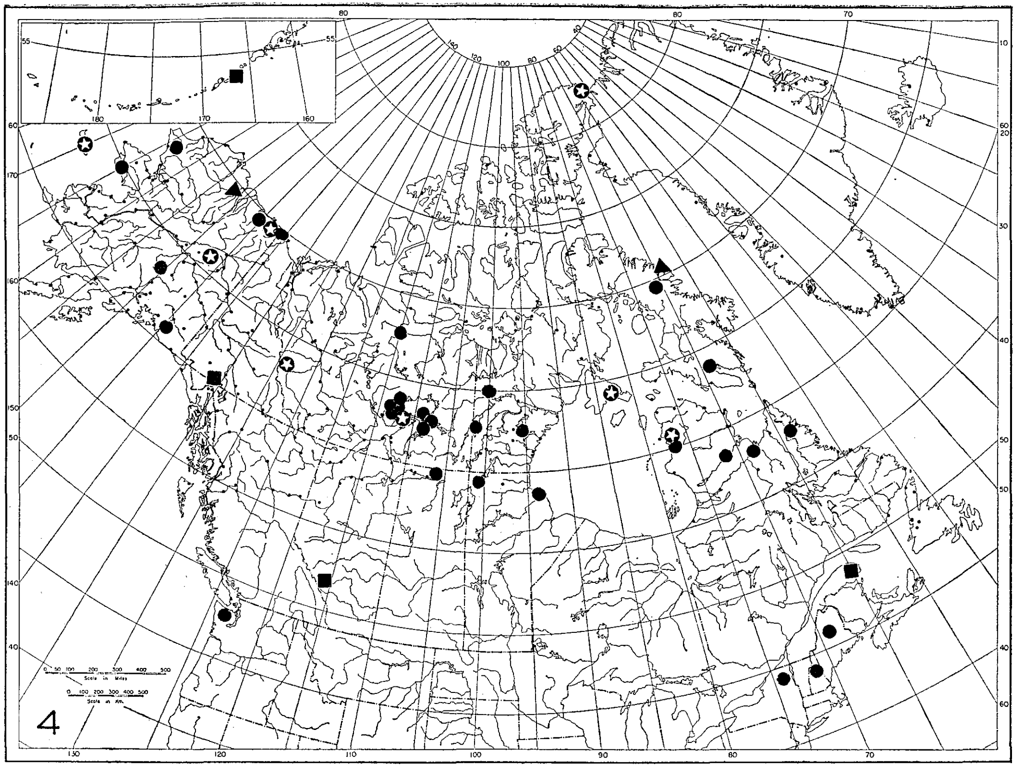

Fig. 4. The distribution of *Haematomma lapponicum* in North America. Solid dots indicate those specimens containing usnic and divaricatic acids; stars indicate those containing barbatic acid in addition, and triangles, those containing zeorin. The squares represent reliable literature reports with the contents not checked.

kept them separate for testing. At Coppermine, N. W. T., three thalli (12968, 12700, 12907) all contained usnic and divaricatic acids. At Artillery Lake, east of Great Slave Lake, all 11 thalli (in nos. 12316, 12327, 12335) were also constant in containing the same two acids. At Dubawnt Lake, N. W. T., three thalli also contained only the two acids. Perusal of the map (Fig. 4) will show that all of the localities at which the thalli showed accessory substances, barbatic acid or zeorin, are north of 60°N. latitude. The specimens from farther south apparently do not contain accessory substances. Although it can be surmised that the physiology might differ with adaptation to greater cold or other factors in the environment of the far north, the presence of the plants without the accessory substances over the entire range of the species would indicate that this is not a necessary attribute for survival. In his studies of *Thamnolia* Satô (1963, 1965) showed that those plants containing squamatic and baeomycic acids (*T. subuliformis*) are more common northwards and those with thamnolic acid (*T. vermicularis*) predominate southward. Perhaps the phenomena in the two genera are related.

Unlike the distribution of the thamnolic acid containing material which shows a definite distribution pattern limited to Europe, the barbatic acid strain of *H. lapponicum* is distributed throughout the general range of the species. It would appear possible that the general wide-ranging *H. lapponicum*, with or without barbatic acid, is the more primitive of the pair of species and that *H. ventosum* is a later, thamnolic acid producing, derived, species which evolved in the European sector of the Holarctic.

Distribution *Haematomma lapponicum* has a typically arctic-alpine distribution pattern as shown by the map (Fig. 4). It is circumpolar on rocks, mainly acidic, in the higher latitudes. In the eastern United States it ranges southward in the mountains. It was reported on Mt. Albert, Gaspé, by Macoun and occurs on Mt. Katahdin, Maine, Mt. Moosilauke and the Presidential Range in New Hampshire, Mt. Mansfield in Vermont, and the Adirondack Mts. in New York. In the west it also ranges southward in the mountains. Macoun reported it from Banff, Alberta, and it has been collected in the Olympic Mountains in Washington.

Specimens Examined Unless additional acids are mentioned, all contain usnic and divaricatic acids. The specimens are in the herbarium of the University of Wisconsin unless otherwise noted.

LABRADOR: Crater Lake 52 mi. w. of Hebron, *Gillett* 8875.

QUEBEC: Ungava Peninsula: Fort Chimo, *Thomson* 13793; Great Whale River, *Thomson* 13410, 13369; 100 mi. up the Leaf River, *Marr* 121; Richmond Gulf, Cairn Island, *Marr* 487 (+barbatic); 489; Richmond Gulf, *Lepage* 6593.

ARCTIC ISLANDS: Ellesmere Island: Alert, *Schuster* 35423; Mt. Pullen, *Schuster* 35757a (+barbatic); Axel Heiberg Island, White Glacier, *Kuc* 26; Baffin Island: Clyde Fiord, *Hale* 276 (+zeorin); Barnes Ice Cap, *Hale* 468; Frobisher Bay, Hale 365; *Thomson* 13299; *Swales* s. n.; Southampton Island: Hudson Bay Post, *Ritchie* 1453 (+barbatic).

NORTHWEST TERRITORIES: KEEWATIN DISTRICT: Dubawnt Lake, *Thomson* 14506; Kaminuriak Lake, *Scotter* 4319; Aberdeen Lake, *Scotter* 3959; MACKENZIE DISTRICT: Artillery Lake, *Thomson* 12316, 12327, 12335, 12347; Fort Reliance, Great Slave Lake, *Thomson* 12051; Gordon Lakes area: Desperation Lake, *Scotter* 1578, 1649 (+barbatic), 1666, 2019b (+barbatic); Ross Lake, *Scotter* 3752; Beniah Lake, *Scotter* 1790; Thistlethwaite Lake, *Scotter* 2024, 2024n; McKeever Lake, *Scotter* 207; Coppermine, *Thomson* 12700, 12907, 12983, 12968; Mackenzie Mountains, O'Grady Lake, *Cody* 16777 (+barbatic); Munn Lake (63°35′N., 110°02′W), *Cody* 15927, 15930.

MANITOBA: Churchill, *Thomson* 3733; Fort Hall Lake, *Scotter* 2884.

ALASKA: Eagle Summit, Steese Highway, *Lutz* 1489 (+barbatic); Thompson Pass n. of Valdez, *Thomson* s. n.; Franklin Bluffs on the Saganavirktok River, *Koranda* s. n.; *Thomson & Shushan* 10861; Sahligvik Ridge near Cape Thompson, *Melchior* 588; Okpilak Lake, Okpilak River, *Thomson & Shushan* 9155, 10160, 10390 (+barbatic); Umiat, *Thomson & Shushan* Lich. Arct. 76, 6239, 10279 (+zeorin), 10290; Mt. McKinley Nat'l. Park, Mt. Eielson, *Weber & Viereck* 7037; Cape Nome, *Dunbar* 3004A; St. Lawrence Island, Boxer Bay, *Sauer* 1213; Degelius (1937) reported it from Unalaska Island, Unalaska (not seen).

MAINE: Davis Pond, Northwest Basin, Mt. Katahdin, *Ogden & Crofutt* 5054.

NEW HAMPSHIRE: summit Mt. Moosilaukee (4700 ft.), *Cummings* Decades North Amer. Lich. 313; Presidential Range, *Dillman* s. n. (herb. JWT).

NEW YORK: summit Whiteface Mt., Adirondack Mts., *Thomson* 11187.

VERMONT: Mt. Mansfield (4000 ft.), Dutton 1727 (DUKE, not seen, reported by Culberson, 1963).

WASHINGTON: Olympic Mts., near Humes Glacier (5500 ft.), *Frye* 41 (FH, not seen, reported by Culberson, 1963).

SIBERIA: transbaikalensis, regio Tschita, kreis Kalarsk, in valle fl. Konda, *Preobrazhensky* 40 (WIS) (+barbatic). This is in addition to the Siberian report by Culberson.

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イワザクロゴケ (*Haematomma lapponicum*) は *H. ventosum* に似ているが，K－の反応で区別されることが Räsänen によって指摘され，またこの両者の予報的研究は Culberson (1963) によって発表されている。筆者は欧州産の *H. ventosum* は朝比奈が指摘した通りタムノール酸を含み，さらにその他にウスニン酸，ジバリカート酸，バルバチン酸を含むことを認めた。北米産の標本はすべて K－のイワザクロゴケであり，ウスニン酸とジバリカート酸を常成分とし，時にはバルバチン酸，さらに稀にゼオリンを含むことを確認した。また，化学成分を異にするこれらの chemical strain の北米における分布を第 4 図に示した。